Erratum to: Differential branching fraction and angular analysis of Λ b 0 →Λμ+μ− decays

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Erratum: Differential branching fraction and angular analysis of $\Lambda_b^0 \to \Lambda\mu^+\mu^-$ decays

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The angular distribution of the dimuon system of the decays $\Lambda_b^0 \to \Lambda\mu^+\mu^-$ and $\overline{\Lambda}_b^0 \to \overline{\Lambda}\mu^+\mu^-$ can be described by

$$\frac{\mathrm{d}\Gamma}{\mathrm{d}\cos\theta_\ell} = \frac{3}{8}(1+\cos^2\theta_\ell)(1-f_\mathrm{L}) + A_\mathrm{FB}^\ell \cos\theta_\ell + \frac{3}{4} f_\mathrm{L} \sin^2\theta_\ell \,, \tag{1}$$

where A_FB^ℓ is the forward-backward asymmetry of the dimuon system and f_L is its longitudinal polarisation fraction. For the Λ_b^0 decay, the angle θ_ℓ is calculated as the angle between the direction of the μ^+ lepton, in the rest frame of the dimuon pair, and the direction of the dimuon pair, in the rest frame of the Λ_b^0 decay. The forward-backward asymmetry of the lepton pair, A_FB^ℓ, is "odd" under *CP* conjugation and changes in sign between the Λ_b^0 and $\overline{\Lambda}_b^0$ decays. To compensate for this sign, the angle θ_ℓ is usually calculated from the μ^- lepton rather than the μ^+ lepton such that A_FB^ℓ can be calculated from the combined sample. This was the intended approach of this paper. Unfortunately, A_FB^ℓ was determined using the μ^+ lepton when determining θ_ℓ for both the Λ_b^0 and the $\overline{\Lambda}_b^0$ decays. Consequently, the value of A_FB^ℓ in this paper corresponds to a difference $A(A_\mathrm{FB}^\ell)$ in asymmetries between the Λ_b^0 and $\overline{\Lambda}_b^0$ decays rather than a proper average and is expected to be zero if *CP* is conserved. The result quoted as A_FB^ℓ in this paper should therefore be interpreted as

$$A(A_\mathrm{FB}^\ell) = -0.05 \pm 0.09\,(\mathrm{stat}) \pm 0.03\,(\mathrm{syst}) \,, \tag{2}$$

and is indeed consistent with the Standard Model expectation that *CP* violating effects should be small in the decay $\Lambda_b^0 \to \Lambda\mu^+\mu^-$. This is in itself a useful result. A measurement of A_FB^ℓ has since been presented in ref. [1]. The results in ref. [1] supersede the corresponding results in this paper. Note, the mistake in the angular definition only affects the value of A_FB^ℓ presented in the paper. The values of f_L, A_FB^h and the differential branching fraction are unchanged, due to the symmetry of the efficiency model in $\cos\theta_\ell$.

References

[1] LHCb collaboration, *Angular moments of the decay $\Lambda_b^0 \to \Lambda\mu^+\mu^-$ at low hadronic recoil*, *JHEP* **09** (2018) 146 [arXiv:1808.00264] [INSPIRE].

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